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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/816,051

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Sundar Vedula

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BLAKELY SOKOLOFF TAYLOR & ZAFMAN LLP
1279 OAKMEAD PARKWAY
SUNNYVALE, CA 94085-4040

EXAMINER

HUBER, JEREMIAH C

ART UNIT

PAPER NUMBER

2621

MAIL DATE

DELIVERY MODE

12/10/2008

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/816,051	Applicant(s) VEDULA ET AL.	
	Examiner JEREMIAH C. HUBER	Art Unit 2621	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 July 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-6,8-17,19-23 and 26-31 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6,8-17,19-23 and 26-31 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 31 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 7/31/2008 has been entered.

Specification

1. The disclosure is objected to because of the following informalities: Claims 12-19 recite a 'computer readable storage medium'. It is noted that the applicant's specification, in paragraph 43 indicates a computer readable medium and definitions, and further discloses a storage medium. However there is no explicit disclosure or definition of a computer readable storage medium sufficient for one to differentiate the computer readable storage medium, from the described computer readable medium. See 37 C.F.R. 1.75(1)(d).

Appropriate correction is required.

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

2. Claims 12-17 and 19 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. The claims recite a "computer readable storage medium". However, the specification indicates that such a medium can comprise a carrier wave (Spec. par. 43). Therefore, the invention can correctly be interpreted as an electromagnetic signal which is non-statutory. See MPEP 2106.01.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1-6, 8-17, 19-23 and 25-31 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

The claims recites a motion estimation method generally applicable to multi-view video that constrains the search range associated with a second frame to an area relative to the position of an epipolar line in the second frame which corresponds to one or more pixels in the first frame. The claim further discloses that the search range is defined by a desired correlation between efficient compression and semantic accuracy. The claim also states that semantic accuracy relies on the use of geometric

configurations of cameras capturing the multi-view video sequence. The applicants specification indicates that a semantically accurate match reflects the 'true' motion in the video sequence rather than simply a good match for efficient compression (Spec. pars. 5 and 23). The applicants claims and specification thus assert that such semantic accuracy is obtained by matching portions of a current frame to portions of a previous frame by searching in an area near an epipolar line in that frame. The examiner does not believe that the applicants claims enable one of ordinary skill in the art to make or use the invention.

The MPEP indicates that a rejection based on enablement should begin by providing a basis on which to question the enablement provided by the applicant's specification. See MPEP 2164.04. First, the applicants claims do not enable use of the invention to select a desired trade-off between efficient compression and semantic accuracy. In a multi-view sequence of known geometry the image of a three dimensional object captured from one view is constrained to lie upon an epipolar line in another image. This relationship is commonly used as a constraint for determining a disparity between two images taken at the same instant in time. However, if the three dimensional object moves it is no longer constrained to lie upon the same epipolar line (See Multiple View Geometry in Computer Vision (hereafter Hartley), Fig. 8.2(b) on page 220 showing different epipolar lines as object moves). The applicants invention asserts that 'true' matches for an object in a first frame can be obtained by searching near or along an epipolar line at a corresponding position in a second frame captured at a different instance in time, which will hereafter be referred to as the corresponding

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epipolar line. As shown in Hartley Fig. 8.2 if an object has undergone motion in the time between the capturing of the two frames the epipolar line determined in the second frame will be a different epipolar line than the object may be found upon within that second frame. The epipolar line upon which the object can actually be found in the second frame will hereafter be referred to as the object epipolar line. An object in an image is not necessarily constrained by a particular epipolar line over time. Therefore a search along the corresponding epipolar line is not equivalent to a search along the object epipolar line, and does not necessarily have any affect on finding a 'true' or semantically accurate motion. Based upon the understanding above, the examiner does not believe that the applicants invention, without further guidance, explicitly enables a selection between semantic accuracy and efficient compression.

Having established a reason for doubting the accuracy of the applicants specification the examiner will now turn to determining if such inaccuracies would require undue experimentation. The MPEP indicates that the factors to be considered in determining undue experimentation may include the breadth of the claims and the amount of direction provided by the inventor.

The claims relate to multi-view video encoding, but are claimed to apply generally to all types of motion in the encoding of multi-view video. The evidence listed above casts doubt as to whether the invention as described in the specification will function for general motion. The invention may have applications when the motion occurs from known camera motions where epipolar constraints can be derived (See Hartley 8.3 pages 228-231). However, the applicant does not mention camera motion, or given any

direction to deriving epipolar constraints from camera motion. Therefore, the examiner believes that an undue amount of experimentation would be required to determine where the invention would be applicable.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1-3, 12-14, 20-22 and 26-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sohn et al (20030202592) in view Chen (6043838).

In regard to claim 1 and 2 Sohn discloses a multi-view video encoding method and apparatus that includes:

identifying one or more pixels in a first frame of a multi-view video sequence (Sohn Fig. 2 and par. 12 note block based motion/disparity prediction will select a block of pixels for prediction);

constraining a search arrange associated with a second frame of the multi-view video sequence the second frame offset in time from the first frame (Sohn. Fig. 3 and pars. 11-16 note motion/disparity prediction for right pictures from left pictures offset in time, further note par. 52 setting constraints on disparity searches may be set as desired); and

searching the second frame within the constrained search range for a match of the one or more pixels identified in the first frame for subsequent use in computing a motion vector for the one or more pixels (Sohn pars. 11-16 note disparity prediction and disparity vectors).

It is noted that Sohn does not disclose particular details relating to motion/disparity estimation. However, Chen discloses a multi-view video encoding method in which a search range in a second frame is constrained relative to the position of the one or more pixels in the first frame, and further discloses finding a position of an initial seed using a disparity vector (Chen Fig. 9 and col. 7 line 38 to col. 8 line 18 note determining an initial seed for horizontal displacement, specifically col. 8 lines 12-18 initial seed may have a value between 5 and 15 pixels offset, further note col. 10 lines 36-59 note disparity estimation compares macroblocks in a 24x24 search area around the seed, in the given example the search area is constrained to include second frame pixels corresponding to the selected pixels in the first frame). It is therefore considered obvious that one of ordinary skill in the art at the time of the invention would recognize the advantage of including motion/disparity prediction as taught by Chen in the motion/disparity estimation of Sohn in order to improve coding efficiency in multi-view video as suggested by Chen (Chen col. 3 lines 61-64).

It is further noted that neither Sohn nor Chen explicitly disclose constraining a search area relative to the epipolar line. However, both Sohn and Chen relate to multi-view video therefore for any given pixel in an image there is inherently an associated epipolar line that describes constraints between the image and a concurrent image from

another viewpoint. Chen further discloses that pixels in the second frame corresponding to the identified pixels in the first frame may be included in the constrained search area. Therefore, Sohn in view of Chen discloses constraining a search range associated with a second frame of a multi view sequence to an area relative to a position of an epipolar line in the second frame because at least a portion of the epipolar line is within the search range.

It is further noted that neither Sohn nor Chen expressly disclose that the constrained search area is defined by a desired correlation between efficient coding and semantic accuracy. However, any constrained disparity/motion search inherently represents some desired correlation between efficient coding and semantic accuracy. A less constrained will inherently improve coding efficiency by increasing the number of possible matches and thereby improving compression, whereas a constrained or smaller search is likely to improve semantic accuracy because most frame to frame motion in a video sequence has a small magnitude. Therefore any search area inherently define some correlation between efficient coding and semantic accuracy.

In regard to claim 2 refer to the statements made in regard to claim 1 above. Further note that the position of an epipolar line inherently depends on the geometric configurations of cameras.

In regard to claim 3 refer to the statements made in the rejection of claim 1 above. Sohn and Chen both disclose blocks of pixels (Sohn par. 12, Chen col. 10 lines 48-58)

In regard to claims 12-14, 20-22 and 26-28 refer to the statements made in the

rejection of claims 1-3 above.

4. Claims 4-6, 15-17 23, and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sohn et al (20030202592) in view Chen (6043838) and in further view of Van Horn (6243599).

In regard to claims 4 and 5 refer to the statements made in the rejection of claim 1 above. It is noted that neither Sohn nor Chen disclose details of calculating epipolar lines, however Van Horn discloses a method of calculating epipolar lines in a multi-view video system using a fundamental matrix (Van Horn col. 9 line 36 to col. 10 line 38). It is therefore considered obvious that one of ordinary skill in the art would recognize the advantage of including epipolar line computations as taught by Van Horn in the invention of Sohn in view of Chen in order to reduce prediction processing for concurrent disparity estimations as suggested by Van Horn (Van Horn col. 10 lines 3-15).

In regard to claim 6 refer to the statements made in the rejection of claim 1 above. Chen further discloses determining the parameters of a window covering the initial seed and the epipolar line based on the desired correlation between efficient compression and semantic accuracy (Chen col. 10 lines 48-58 note determining center point (x,0) for the search window)

In regard to claims 15-17 23, and 30, refer to the rejection of claims 4-6, 12, 20 and 26 above.

5. Claims 8-11, 19, 25 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sohn et al (20030202592) in view Chen (6043838) and Newman et al (6154600) and in further view of Van Horn (6243599).

In regard to claims 8-11 refer to the statements made in the rejection of claim 1 above. It is noted that neither Sohn nor Chen disclose specifics details regarding user input. However Newman discloses a video editing system in which a user can input parameters through a slider in a user interface (Newman col. 14 lines 59-64). It is therefore considered obvious that one of ordinary skill in the art at the time of the invention would recognize the advantage of including user input through a slider window in a user interface as taught by Newman in the invention of Sohn in view of Carlborn in order to allow closer user control over the process.

In regard to claims 19, 25 and 31, refer to the rejection of claims 8-11, 12, 20 and 26 above.

Response to Arguments

Applicant's arguments with respect to claims 1-6, 8-17, 19-23, and 25-31 have been considered but are moot in view of the new ground(s) of rejection.

In response to the applicants arguments made in regard to the objection to the specification, and rejection of claims 12-19 under 35 U.S.C. 101, the applicant asserts that because a storage medium has been held to be patentable by the federal circuit and a carrier wave is not patentable, a claim to a computer readable storage medium cannot be interpreted as carrier wave and is thus patentable. The examiner must

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disagree. The examiner notes that a properly claimed and supported storage medium is patentable subject matter. The issue in the instant case lies in support. The specification does not explicitly provide for a computer readable storage medium, rather the specification describes computer readable media and indicates that such media can be a storage device or a carrier wave. Because the specification does not explicitly define 'a computer readable storage medium' there is insufficient basis to differentiate between the computer readable medium, which includes carrier waves, and the 'computer readable storage medium' which the examiner presumes is intended to cover only storage devices. To alleviate the issue the examiner would recommend reverting to the claim language to a 'computer readable medium' and in the next response specifically pointing out which types of computer readable media are claimed and disclaiming all others.

Conclusion

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JEREMIAH C. HUBER whose telephone number is (571)272-5248. The examiner can normally be reached on Mon-Fri 8:00 a.m. - 4:30 p.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mehrdad Dastouri can be reached on (571)272-7418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jeremiah C Huber
Examiner
Art Unit 2621

/Jeremiah C Huber/
Examiner, Art Unit 2621

/Mehrdad Dastouri/
Supervisory Patent Examiner, Art Unit 2621